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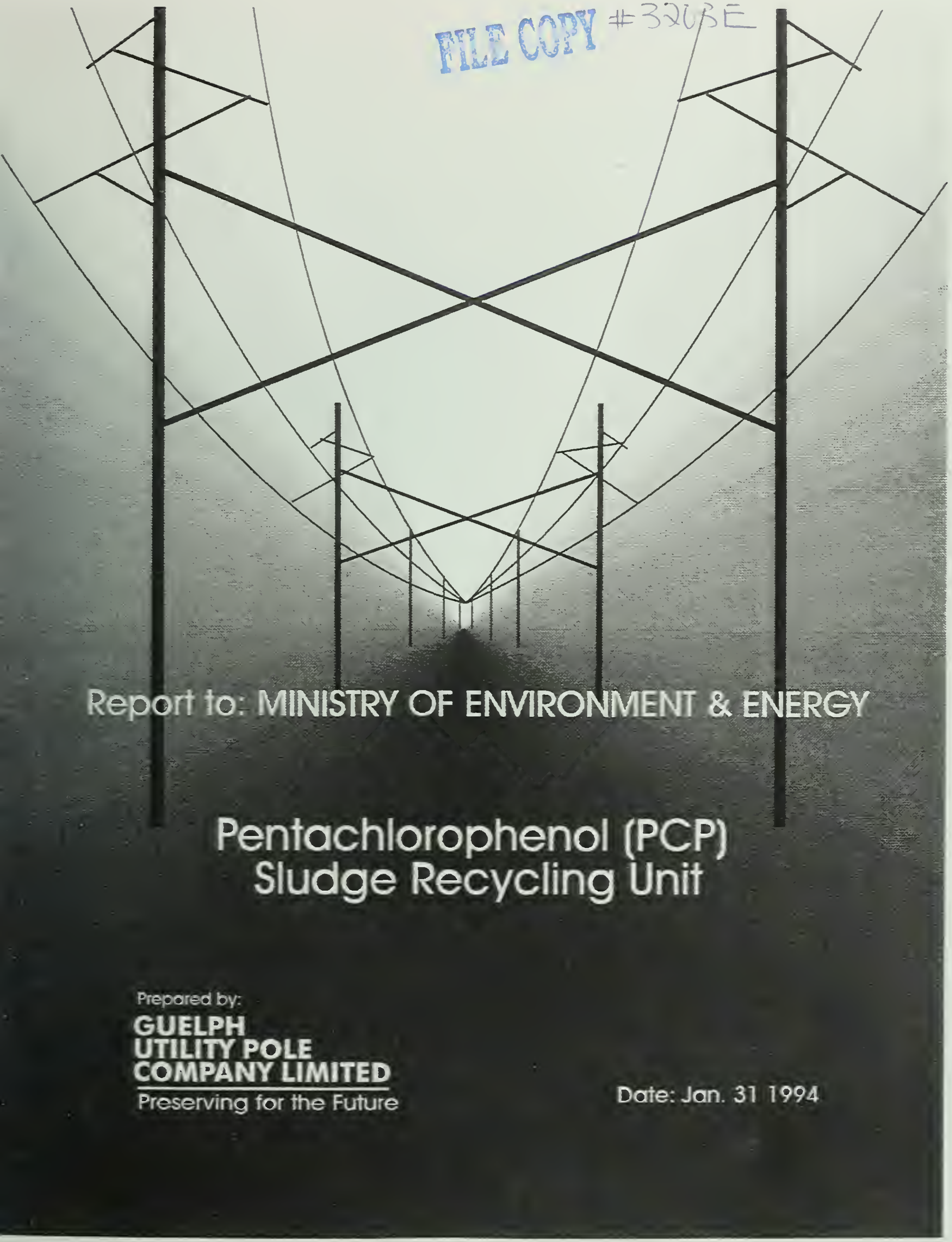

Report to: MINISTRY OF ENVIRONMENT & ENERGY

Pentachlorophenol (PCP) Sludge Recycling Unit

Prepared by:

GUELPH
UTILITY POLE
COMPANY LIMITED
Preserving for the Future

Date: Jan. 31 1994

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PENTACHLOROPHENOL (PCP)

SLUDGE RECYCLING UNIT

AUGUST 1994

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PENTACHLOROPHENOL (PCP)

SLUDGE RECYCLING UNIT

Report prepared for:

ESSD/Program Development Branch
Ontario Ministry of Environment and Energy

Report prepared by:
Guelph Utility Pole Company Limited

DISCLAIMER

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GUELPH UTILITY POLE COMPANY LIMITED (GUPCL)

"Recycling Pentachlorophenol (PCP) Sludge"

31st January 1994.

1.0 ABSTRACT:

This report describes a Pentachlorophenol (PCP) sludge recycling program at the Guelph Utility Pole Company Limited, (GUPCL), Guelph, Ontario. The company submitted an application to the M.O.E.E. (formerly known as the Ministry of the Environment, M.O.E.) for an Industrial Waste Diversion Program (I.W.D.P.) grant. The company received a grant to;

a) build an experimental pilot PCP sludge recycling unit and

b) build a full-scale PCP recycling unit.

This report is part of the grant requirement.

2.0 PROGRAM OBJECTIVES:

The main objectives of the program are described below:

1) Identify factors which produce Pentachlorophenol (PCP) sludge,

2) Identify technologies which reduce and recycle PCP sludge and

3) Design, build and utilize a system for recycling PCP sludge.

This included; a review of experience in Canada, the United States and elsewhere; an experimental test program to study various techniques; and the construction and full-scale operation of a prototype recycling system.

3.0 EXECUTIVE SUMMARY:

At the Guelph Utility Pole plant PCP sludge was processed and recycled in a specially designed PCP waste recovery unit. This PCP waste recovery unit was designed for full-scale use in a plant with process optimization, plant and environmental control and economy being important considerations. Two of the products generated from the PCP recycling process, oil and water, (approximately 98% of the sludge) were of sufficient quality to be reused in the processing of poles and lumber. The remainder of the sludge, solid waste (less than 2%) was placed in appropriate containers for disposal at a secured landfill site.

The introduction of the PCP waste recovery system in addition to improved processing have resulted in;

- Recycling of thousands of gallons of PCP sludge stored on-site,
- Recycling of thousands of gallons of PCP sludge generated annually by the PCP treatment process.
- Elimination of long-term storage of PCP sludge,
- Construction of a new PCP facility and significant reduction in overall waste generation,
- Upgraded storage and containment facilities resulting in minimum risk of site contamination,
- Significant safety improvements and energy savings,
- Automated control and superior plant efficiency.

4.0 PLANT DESCRIPTION:

Guelph Utility Pole Company Limited has one of the largest and most sophisticated utility pole treatment facilities in Ontario and the general layout of the plant is illustrated in FIGURE 1.

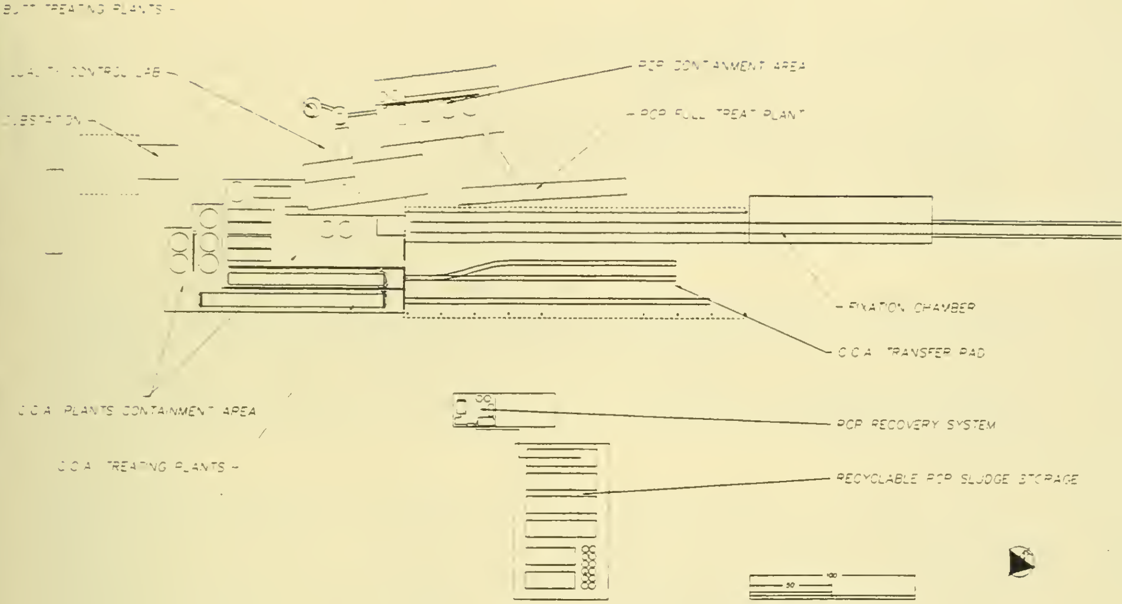
Telephone and hydro poles are;

1) thermally treated by immersion in a tank of hot pentachlorophenol (PCP) /carrier oil mixture or,

2) treated under pressure by chemical infusion with a chromated copper arsenate (CCA) solution in a cylinder, followed by fixation in a non-vented kiln.

Pentachlorophenol, PCP, is a wood preservative used by GUPCL and the majority of North American utility pole producers/users. Poles may last 40 years or more under environmental conditions which destroy untreated poles in a fraction of that time. They are generally regarded as safe, "clean", cost-effective and environmentally acceptable. The company has used this process to produce utility poles for over 10 years, ie. by applying PCP preservative to raw wooden poles. The procedures for PCP wood treatment are specified in standards developed by the Canadian and American Wood-Preservers Associations ie to C.S.A. standards. PCP treated poles are a high value-added product and more durable (less susceptible to weathering and degradation) than white untreated poles.

FIGURE 1



GENERAL LAYOUT OF GUPCL PLANT

The company also has a pressure treatment facility for applying chromated copper arsenate (CCA) to cut lumber and poles and also uses a state of the art non-venting fixation/drying kiln. The CCA process with fixation is an excellent wood treating process and may one day replace other wood treating methods. The materials and treatment process used in the CCA plant are unique to that form of treatment, do not generate PCP sludge and as a result are not discussed further.

In Canada and the United States there are numerous wood treating facilities which use the PCP process. In general, control and close supervision are required to obtain optimized pole treatment. When the appropriate conditions are met, chemical concentrations and temperatures are maintained within proper limits. However, the treatment process may be improved with the addition of automated controls. When appropriately applied they may assist in producing a more consistent quality product, with less waste. The degree of plant/process sophistication varies from plant to plant but generally many wood treating plants rely on manual control.

During pressure or thermal treatment of poles with heated solutions of PCP-in-oil, PCP contaminated "sludge" is formed. This sludge is a complex mixture of oil/water/penta emulsions and penta/oil contaminated sawdust and solids. The emulsion component is extremely difficult to break down into its various components. At the time of the GUPCL proposal to the M.O.E.E., a large volume of sludge was stored on the company's property.

The new owners of GUPCL decided to conduct a review of operations to provide an environmental and technological assessment of the wood-treating and downstream processes. The objective was to define; the environmental impact, the technical and scientific merit of potential processes and innovative commercial/environmental improvements for this wood treating facility and demonstrate suitability of the CCA wood products (produced in a fixation/drying kiln of revolutionary design) and process changes eg. the addition of a PCP waste recovery system. Assessment involved external consultant studies, a research programme at the University of Toronto, discussions and trips to other plants, measuring environmental impact, observing operating practices and modelling or analyzing available data. In the pilot study, GUPCL was able to recover, recycle and reuse 98% of the sludge produced by the PCP system. Approximately 35% by weight of the sludge is P-9 oil and PCP. This component can be reused in the PCP treating process. Approximately 63% of the sludge is water that may be recycled in the CCA plant. The remaining 2% of the sludge is a concentrated dry sludge containing wood particles, clay, stones and small quantities of PCP.

There were several suggestions with regard to how this dry solid waste could be treated;

1) "Bio-remediation", a process in which carefully selected microbes, known to exist and thrive (by consuming/breaking down a specific material or compound eg, PCP) in a specific environment, are maintained in a preselected containment area to naturally reduce the compounds of interest, ie PCP sludge/clay, to environmentally acceptable materials,

2) Safe containment using the "Hazcon" cement process or

3) Disposal in a secured landfill site.

A survey of the plant indicated that;

a) Replacement of the old system, with a environmentally sensitive PCP treatment facility,

b) Addition of a newly designed CCA treatment plant containing non-emitting non-vented fixation/drying kiln and

c) Construction and use of a separate PCP sludge recycling system (all of innovative design);

would result in substantial reductions of chemical leachate from treated wood and emissions to the environment; air, water and ground.

As a consequence, action was taken to address all of the above issues. This resulted in the GUPCL wood treating facility being substantially remodelled and many parts of it rebuilt.

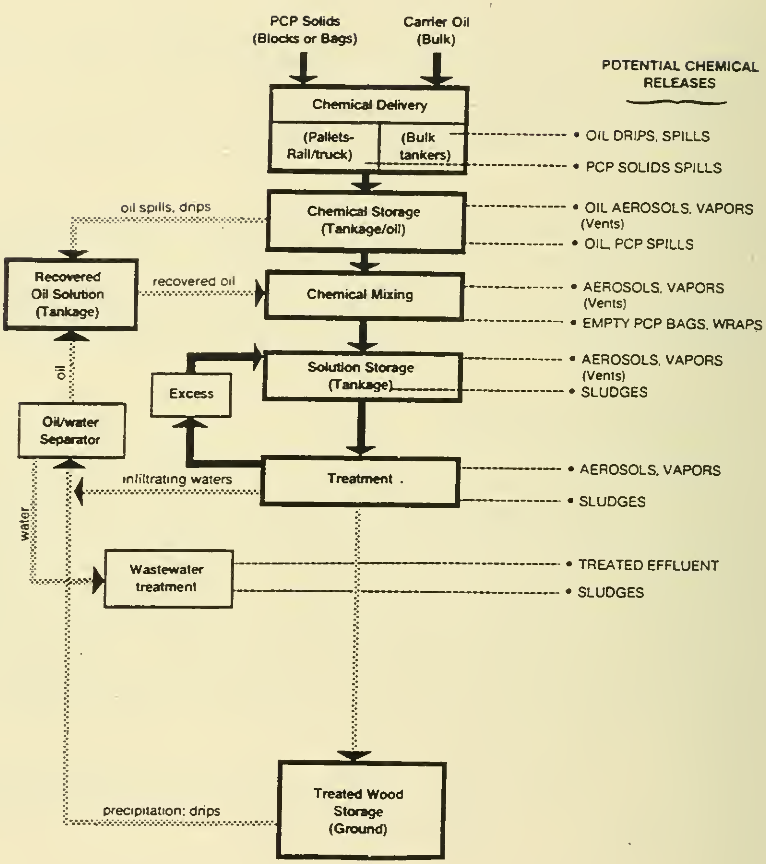
5.0 PCP TREATMENT PROCESS:

The wood products and PCP treating process are briefly described below. In the PCP "Full Treatment" process, poles are laid in a full-length (17.5 m) horizontal oil-bath or vertically in a butt treatment tank. Initially a PCP-oil solution is pumped into the oil-bath and heated to 205 degree F for approximately 8 to 12 hours. On completion the hot PCP-oil solution is removed from the oil-bath or treatment tank and refilled with PCP-oil solution which is heated to 100 degrees F for approximately 4 - 6 hours. This solution is removed and the poles permitted to cool and dry for several hours. After treatment the poles are removed and placed in storage and subsequently shipped to customers. FIGURE 2 is a flow diagram of a typical PCP treatment plant including a list of potential chemical releases.

It should be noted that this process has been used in North America for approximately 50 years with only recent changes to the process, such as containment, recycling and automated controls.

In general, the system is labour intensive, often difficult to control to optimum efficiency and has the potential to contaminate the area surrounding the treating plant and storage areas/facilities. This appears to have been a common factor in many North American PCP treatment plants in the years prior to implementation of strict government environmental regulations and changing customer expectations and specifications.

FIGURE 2



SCHEMATIC OF A TYPICAL PCP TREATMENT PROCESS

The new GUPCL treatment process has several significant advantages to traditional systems. Improvements include computerized controls, double containment, optimized processing, spill/drippage collection, monitoring/alarms and other numerous additions or refinements. The process allows various wood-products to be preconditioned to an optimum state with minimum waste. It should be noted that the automatic controls used to control and maintain all the functions of the treatment process ensuring safe clean operation were designed by GUPCL personnel.

The project to improve the processing/treatment of poles and substantially reduce and recycle waste was the result of many factors including; major capital outlays, extensive Research and Development eg "table-top" testing and collaboration with a local university, discussions with various government bodies and companies associated with the pole treating industry, PCP treatment trials, engineering and automated process control and optimization.

6.0 PROPOSAL TO M.O.E.E.:

Pentachlorophenol sludge is a hazardous waste consisting of water, P-9 oil, pentachlorophenol and wood by-products. At the time of the GUPCL proposal to the M.O.E.E. a disposal system for PCP sludge created by the pole treating process was not available. The process GUPCL proposed allowed for the reduction, recycling and reuse of all the PCP sludge created. GUPCL proposed to apply the 3R's to the PCP sludge in the following manner;

1. Water removed from the PCP sludge would be recycled in the C.C.A. pressure treating plant.

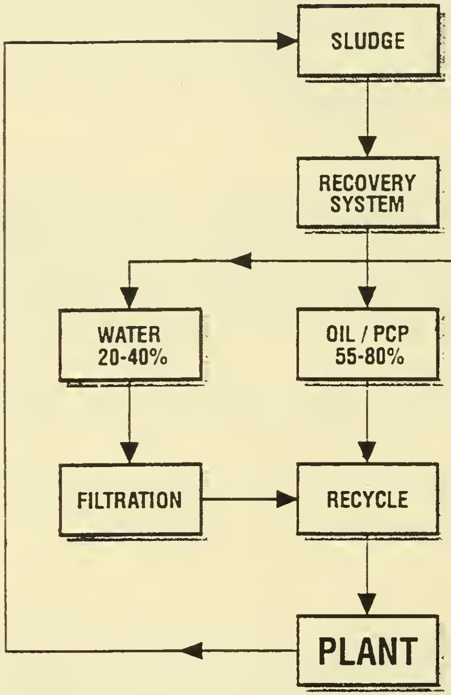
2. P-9 oil and PCP recovered from the sludge would be reused in the thermal treating plants.

7.0 PCP RECOVERY UNIT:

PCP recovery is achieved by using a state-of-the-art recycling system. This involves the removal of solids and PCP/oil contaminants from the water. It is modular in design and can be modified to suit different requirements. For example, permanent systems may be designed for applications where waste water requires processing on a continuous basis. The concentrated solid sludge was also considered for conversion into cement pole racks or other cement products. Another application could involve the use of mobile units. This may be appropriate in smaller treatment plants where the volume of waste is much lower. FIGURE 3 graphically describes how the sludge is broken down into its component parts and recycled.

FIGURE 3

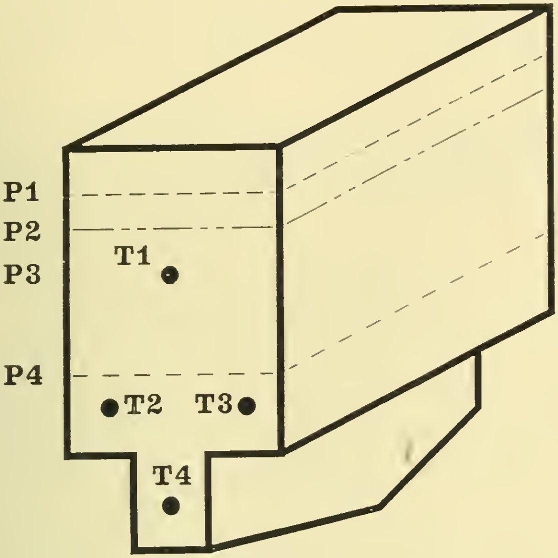
PCP RECOVERY SYSTEM



PCP RECOVERY FLOW CHART

During the recycling operation sludge is pumped through the PREHEAT system (preheated by waste energy) from the RECOVERY SYSTEM storage tanks in a containment area. Suspended solid material is removed by passing the sludge through a wire mesh strainer. Filling the storage tank is automatically controlled and the valve is closed when the P2 level is achieved, see FIGURE 4.

FIGURE 4



LEVELS

P1 – OVERFLOW , ALARM
P2 – HIGH FULL
P3 – LOW FULL
P4 – LOW CYCLE

TEMPERATURES

TEMPERATURES IN THE INTERNAL TAN
ARE CONTROLLED IN SEPARATE ZONES
T1 , T2 , T3 , T4 .

CONTROLS/LEVELS/THERMOCOUPLES

The flow through the strainer is controlled by isolation valves at the outlet of the strainer. Electronically controlled electric heaters increase the temperature of the sludge to a pre-set temperature. The inside zones are labelled A, B, C, D and OVER TEMP. The outside zones are labelled 1, 2, 3 and 4. Thermocouples are used to control the outside zones. Zones B, C and D cycle on and off to maintain a steady heat flow to the tank. At a pre-determined temperature the sludge begins to separate into its component parts; oils, steam (water) and solids. The steam condenses to water containing low concentrations of light oil. This solution is pumped through a specially designed high performance oil/water separator. The seperator removes oil from the water and the oil is reused in the wood treatment process. The remaining water is tested to determine if further treatment is required. If the oil/water separator permits more than 0.2% oil by volume to pass through the system, a specially designed sensor trips a gate valve and flow is redirected back to the RECOVERY SYSTEM storage tanks for further processing.

If the test is negative, the water is added to the working solution in the CCA plant. The heating process continues until zone A reaches a pre-determined temperature setting or the sludge level drops below the P3 level sensor. The outside zone heaters will shut off if zone A becomes too warm. It has been determined from experience that when zone A reaches a specific temperature that all the water has been removed from the sludge and the batch process is complete. If the sludge level drops below the level sensor more sludge is added to the oil recovery unit.

When the water has been removed from the sludge two of the sludge components still remain in the recovery unit. The top layer is oil (reusable in the thermal treating process) and the bottom layer is sludge solids. The oil is pumped to the PCP treating plant for reuse and the solid waste, which includes small stones and wood particles, is removed and stored.

8.0 PROJECT RESULTS:

First Quarterly Report.

In addition to fine-tuning and on-going monitoring there were numerous minor start-up problems associated with the project. Typically they were electrical and control in nature and relatively simple to fix. There were also several safety concerns which were addressed by adding more controls, alarms and detectors. In addition, relatively early in the project it was decided to reduce the total volume of waste treated. This was achieved by removing large volumes of water while leaving most of the oil and heavy sludge in the sludge storage tank. This water required further treatment to remove oil contaminants prior to its addition to the CCA pressure treating facility. A cyclone was added to the system to remove suspended solids. Further refinement of the water treatment process was possible by adding an activated carbon filtration system.

After the first few weeks of operation it was also possible to increase the sludge treating capacity with the addition of a night operator.

Second Quarterly Report.

The Pentachlorophenol (PCP) recovery system worked as designed with only minor problems. However during particularly cold weather the sludge (stored in outside tanks prior to treatment), froze solid. The addition of an electric immersion heater to the tank eliminated this problem. In addition, it was believed that sludge processing rates could be increased by up to 500 gallons per day by removing settled water in the sludge storage tank prior to distillation in the recovery vessel. It was found that this was not possible during extremely cold weather because frozen CCA treated poles would not air-dry. As a consequence the frozen poles were kiln dried which resulted in greater volumes of water being generated, (significantly more water per load), compared to what was produced in warmer months) collected and stored. Another factor was snow and ice build-up on the poles which also increased the amount of water generated by removing the water from the sludge tanks. It was found that the CCA plant/process was not able to use the additional volume of water generated and it was stored until required at a later date.

Third Quarterly Report.

The recovery system performed as designed. Approximately 10,000 gallons of sludge were processed during this quarter. This resulted in 6,500 gallons of water, 3,500 gallons of oil and approximately 30 gallons of solids.

9.0 CONCLUSIONS:

GUPCL produces utility poles treated either thermally in an oil-Pentachlorophenol (PCP) solution or, under pressure in a chromated copper arsenate-water (CCA) solution. Waste reduction initiatives were implemented in 1990 (the CCA treatment facility was built in 1992) because both PCP wood preservative and CCA used in the new treatment plant are toxic. There were many reasons for implementation of a waste reduction programme, including a strong moral obligation to reduce the company's impact on the environment, increasing regulatory demands, economics and the wood treatment industry's public image.

The waste reduction programme began with basic changes in plant operation, followed by the design and implementation of new treatment and recycling technologies. The first phase involved the training of plant personnel in the safe handling of wood preservatives and preserved wood products. In parallel an environmental engineering firm was retained to monitor the site and identify points of concern or possible discharge. As each area of concern was identified, positive action was taken to contain the flow of waste, in addition to upgrading or changing facilities which demonstrated potential for discharge to the environment. As a result one treating plant was decommissioned and removed, two were replaced with new safer facilities and the remaining two were extensively upgraded. In addition, a "state of the art" CCA treatment plant was added to the system.

In the final phase of waste reduction a PCP recovery unit was designed and built to reclaim and recycle PCP sludge. This system enabled the company to reuse 98% of the sludge, the remaining solid component (dirt, stones, woodchips etc.) held in storage for further treatment or disposal to a secured landfill site.

The wood-products produced at GUPCL and innovative processing techniques used were designed to improve environmental protection by recycling waste products and chemically fixing preservatives to the wood in a better way. As a result, the environmental impact of the treated wood-products is greatly reduced, ie less waste.

In general, the introduction of the PCP sludge recycling system at GUPCL resulted in;

1) Recycling of thousands of gallons of PCP sludge,

2) Elimination of long-term storage of PCP sludge and

3) Upgraded processing facilities.

10.0 LESSONS LEARNED/FUTURE CONSIDERATIONS:

A summary of lessons learned and future considerations are summarized below;

1) Use automated processes with high quality controls,
2) Use ultrasonic level controls, when appropriate,
3) Use energy recovery/preheat where possible,
4) Maintain a clean system ie remove solid waste on a regular basis,
5) Use a high performance oil/water separator with coalescer,
6) Install overflow and venting tankage and piping to maintain a closed system,
7) Install an epoxy lined floor and high density polyethylene liner system,
8) Optimize processes to minimize waste,
9) Don't vent to environment,
10) Minimize manual controls/ over-rides,
11) Eliminate long term storage.

Acknowledgements:

The processes and products developed have had many inputs, both internal and external. GUPCL gratefully thanks and acknowledges the following groups and organizations for their assistance; the Ministry of Environment and Energy's (M.O.E.E.) Industrial Waste Diversion Program (I.W.D.P.).; the former Ministry of Energy for their "Demonstration grant" (for application of new technology); the University of Toronto and Ontario Hydro for several grants for energy conservation/process optimization.

The work on-site and at the University of Toronto has expanded and improved the current technical knowledge of wood treating. The process has undergone significant improvements, with utilization of systems not extensively used in North America. Many of the improvements were developed at GUPCL and in recognition of the company's efforts towards waste reduction, the Ontario Waste Management Corporation has awarded GUPCL the 1993 "Outstanding Waste Reduction Performance" award, Appendix A.

GUPCL would also like to thank all the individuals involved in this work for their valuable suggestions and input.

Ontario

Ministry of
Environment
and Energy

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l'Environnement
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October 27, 1993

Craig Frohlich
Operations Manager
Guelph Utility Pole Co. Ltd.
P.O. Box 154, R.R. #5
Guelph, Ontario
N1H 6J9

Dear Mr. Frohlich:

Congratulations! Your company has been selected as this year's winner of the Outstanding Waste Reduction Performance Award, sponsored by the Ontario Waste Management Corporation (OWMC).

Your submission outlined a very comprehensive program which met all the criteria for selection of the award winner. All the judges were particularly impressed with the comprehensive approach taken, given the highly toxic nature of your operations. In addition, the dedication and commitment of your management and employees in ensuring the success of the program are highly commendable.

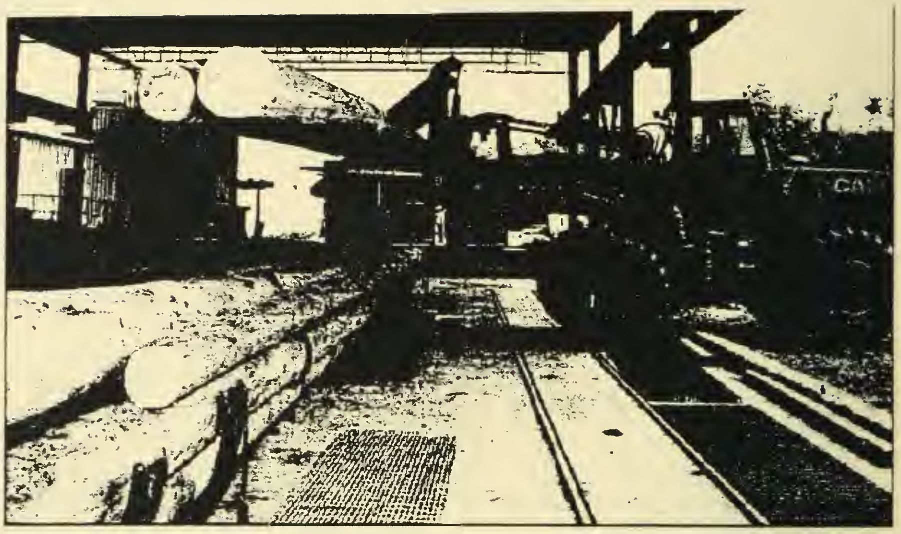
It is our intention to recognize your company's achievements by presenting the award at the Technology Transfer Conference on Tuesday, November 23, 1993. Arrangements for your company's participation at the luncheon will be made by OWMC.

Once again, congratulations from all of us. We wish you many more successes in the future.

Yours sincerely,

B.I. Boyko, P. Eng.
Assistant Deputy Minister
Waste Reduction Office

Appendix A



ALL CLEANED UP: Guelph Utility Pole Company Ltd. was recognized today for winning a waste reduction award from the Ontario Waste Management Corporation. The company has gone from being perceived as an environmental villain to becoming a leader in toxic waste reduction.

Guelph Utility Pole captures major waste reduction award

BY DARCIE PARK
THE GUELPH MERCURY

For Guelph Utility Pole's Howard Frolich, being recognized as one of the industry's environmental leaders is a particularly sweet reward.

After years of bad publicity and wrangling with government officials over environmental contamination, the company has won the 1993 Outstanding Waste Reduction Performance Award from the Ontario Waste Management Corporation. The company was honored today for its environmental cleanup at a Local Recognition Day at its site north of Guelph.

"We're quite happy about what we've accomplished," said Frolich. "We've spent a lot of money on this."

Frolich has spent $2.6 million, to be precise, in the three-year plan to bring his utility pole treatment facility up to his own rigorous environmental standards.

He bought the company in 1990 and was immediately made target of accusations of severe contamination on the site. Many of the accusations were exaggerated, but Frolich used the bad publicity as a catalyst to improve the facility's pole treatment processes.

Guelph Utility Pole Company Ltd. produces poles treated with an oil-pentachlorophenol (PCP) solution or under pressure in a chromated copper arsenate-water solution (CCA). Both solutions are highly toxic.

Among the company's environmental initiatives that led to the award was developing a process to reuse 98 per cent of the components of the sludge produced in the treatment of utility poles in PCP preservative.

The company also developed a kiln which accelerates fixation of the CCA preservative in treated lumber. Previously, the process was allowed to take place naturally over a number of weeks, which meant there was a danger that preservatives could leach from the lumber into the environment.

"We feel good about what we've done because some of (the initiatives) are firsts in the industry," said Frolich.

The company has recovered nearly all the cost of the upgrading project, mostly in savings from hazardous waste disposal.

"Mr. Frolich deserves a lot of credit for this," said Charles Ross of the Ontario Waste Management Corporation. "Any other firm, including the competition, can call him for information and advice (on the processes).

"This guy is interested in the environment."

ontario hydro

5343 Dundas Street West, 5th Floor, Etobicoke, Ontario M9B 6K5

Telephone (416) 207-5603

Guelph Utility Pole Company Ltd., Dec 07, 1993
Attention: Howard Frohlich
President
P.O. Box 155
R.R. 5, Guelph, Ontario.
N1H 6J9

Dear Howie

Ontario Hydro, Material Standards, wishes to congratulate you and your staff on this day of recognition for your outstanding performance in waste management.

Personally having worked with your company these past eight years, where you have become the largest volume supplier of pressure treated poles to Ontario Hydro, know the hard work all your staff have put into achieving this award. Ontario Hydro is proud to tell all that Guelph Utility Pole Company Ltd. is a supplier of quality product with excellent service performance while maintaining the most advanced technology in environmental control.

Keep up the good work and continued success to you.

Ken

Ken Brooks
Purchasing and Commodity Management Department